

6. *On a Collection of Stone-flies (Order Perlaria) from South Africa—*

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(With 13 Text-figures.)

THE subject of this paper is a small collection of stone-flies received for study from the South African Museum, Capetown, through the kindness of Dr. E. L. Gill, Director of the Museum. Most of the specimens were collected by Dr. Barnard, Assistant Director, in the course of his researches on the fauna of the Cape mountain ranges. The collection has proved to be of very great interest both from the systematic and the zoogeographical view-points. The probable existence of a group of PERLARIA of southern (Notogaean) origin was suggested by me (*in litt.*) from the study of the known Perlarian faunas of other southern lands, *e.g.* Australia, New Zealand, and Southern Chile; but it would have been impossible to indicate in detail its probable composition beyond stating that any or all of the three known southern or Notogaean groups would be represented in it. These groups are as follows:—

1. The ancient and extremely restricted family AUSTROPERLIDAE (Tillyard, 1921). As this family lies undoubtedly very close to the actual original stem-form of the whole Order, and is to-day only represented by a single genus, *Austroperla*, in New Zealand, and another closely allied genus, *Tasmanoperla*, in Tasmania and the mountains of South-eastern Australia, one would scarcely expect to find it in South Africa. No representatives of it occur in the present collection.

2. The dominant southern family LEPTOPERLIDAE. This group, consisting for the most part of small, inconspicuously coloured forms, is abundant in New Zealand, particularly in the South Island, in Tasmania, the colder parts of South-eastern Australia, and the colder mountainous regions of South America, including Tierra del Fuego. It has a typical Notogaean distribution and is undoubtedly of southern origin. It appeared to me that there might easily be found representatives of this group in South Africa, and I must admit that it was

mainly with the expectation of discovering such forms that I begged Dr. Barnard to search the mountainous regions of the Cape Province for these particular stone-flies. Nevertheless, no specimens of this family occur in the collection before me, and it seems now extremely doubtful that they occur there at all. We must, however, remember that, although this family is extremely well represented on the mainland of Australia, it remained undiscovered for very many years, owing to the fact that most of the species are very dull, retiring insects, seldom found on the wing, and mostly occurring in late winter or early spring. In Tasmania and New Zealand they are far too abundant to escape notice, and have been known for a much longer period.

3. A small group of peculiar genera belonging to the widespread family NEMOURIDAE (*s. lat.*) and consisting of the genera *Udamocercia* End. (1909) from Tierra del Fuego, *Spaniocerca* Till. (1923) from New Zealand, Tasmania, and South-eastern Australia, and *Notonemoura* Till. (1923) from New Zealand only. These are very small stone-flies, even more inconspicuous than the smaller species of LEPTOPERLIDAE, along with which they usually occur, but in much smaller numbers. I anticipated that some form closely related to *Spaniocerca* would probably occur on Table Mountain and other elevated parts of Cape Province, and in this I have not been disappointed. The present collection contains no less than four species belonging to this group and referable to two distinct genera, both new to science. Dr. Barnard is to be highly congratulated on bringing this interesting group to light.

The systematic interest of these new forms lies in the fact that they undoubtedly form a link between the family NEMOURIDAE (*s. str.*) and the small family LEUCTRIDAE. Enderlein, who defined the first genus of the group, viz. *Udamocercia* (1909), does not accept the opinion of most European specialists that the genus *Leuctra* should constitute a distinct family. He takes all the Nemouroid forms as constituting a single family, NEMOURIDAE (*s. lat.*), which he divides into two subfamilies, TAENIOPTERYGINAE and NEMOURINAE, on the form of the tarsi. (See fig. 2, in TAENIOPTERYGINAE the three segments of the tarsus are nearly equal in length). Other European authors, however, tend more and more to treat the TAENIOPTERYGIDAE as a distinct family, and also separate out the somewhat aberrant genus *Leuctra*, which, on its tarsal characters, belongs to the subfamily NEMOURINAE, as a distinct family of its own, LEUCTRIDAE.

It appears to me that Enderlein takes the wider and sounder

view of the problem. Those authors who study chiefly the European forms cannot fail to note the differences between *Leuctra* and the rest of the European NEMOURINAE, and therefore they tend to separate them out into two distinct families. *Nemoura* itself, including all its component subgenera (which are sometimes considered as good genera) stands out as the most highly evolved member of the whole group, particularly in the highly developed "X-form" venational grouping at and below the endings of the subcosta in both wings. *Leuctra* is also a highly developed type in quite another direction; its venation has never developed the "X-form," but it has specialized in the reduction of the anal area of the hind-wing. It is not possible, logically, to fit any of the three known southern genera into either the *Nemoura*-group or the *Leuctra*-group; they lie just about halfway between them. The new forms discovered in South Africa share this character also. The first question one puts to oneself is "Are these forms NEMOURIDAE or LEUCTRIDAE?" The answer is "Neither." The next question is, whether a new family or subfamily group should be made for them. At this point I feel compelled to join forces with Enderlein, and to point out that it seems most logical to conclude that we are, after all, only concerned with a single complex of family rank, the NEMOURIDAE, into which all these allied forms should go. It then becomes apparent that, as in so many other cases, the southern group of genera is nearest to the original type of the family, and that, in working its way into the Northern Hemisphere, this same group has evolved into at least two, or perhaps (if the TAENIOPTERYGIDAE be included) three distinct types. Even so, I am unable to grant subfamily rank to the genus *Leuctra*, for to do so would again place us in a quandary as to what to do with the southern genera, which share almost equally *Nemoura*-like and *Leuctra*-like characters.

My conclusion, then, is that these forms are to be classified as NEMOURIDAE. On the form of the tarsi, they belong to the subfamily NEMOURINAE, as also does the genus *Leuctra*.

In the collection before me another group of stone-flies is represented, viz. the family PERLIDAE, subfamily NEOPERLIDAE, by a single genus and species. This differs from the other species in the collection in being a larger and more striking form, found further north, and evidently of tropical origin. Thus we find in this restricted South African Perlarian fauna the same two elements, broadly speaking, as we find in Australia, New Zealand, and South America, viz. a true southern or Notogaean remnant and a northern immigrant

race, though the latter does not belong to the group (EUSTHENIIDAE) which occurs in other southern countries.

As a fair amount of the material sent was in alcohol, and as it is impossible to define small and obscure species of stone-flies without careful preparations and mounts, the types of all the new species have been dissected and mounted on slides. The wings are first of all dissected off, cleared and mounted in Canada Balsam. The body is then macerated in 10 per cent. KOH solution, cleared and mounted separately. Where available, both sexes have been thus treated. Pinned specimens are considered as paratypes.

NOTE ON VENATIONAL NOMENCLATURE IN THE ORDER PERLARIA.

It has by now been satisfactorily established that the Order PERLARIA as it exists to-day is a small offshoot of the originally more dominant Order PROTOPERLARIA (family LEMMATOPHORIDAE) so well represented in the Lower Permian Beds of Kansas (Tillyard, 1928*a*, 1928*b*). An analysis of the various types then extant indicates clearly that the genus *Artinska* Till. contains within itself all the necessary ancestral characters for the modern Order PERLARIA. It is logical to assume that all the other Lower Permian genera died out, and that *Artinska* itself, by further specializations, gave rise at some later geological date to the first true representatives of the Order PERLARIA. These cannot have been very different from the existing family AUSTROPERLIDAE.

The study of the Order PROTOPERLARIA resolves some outstanding puzzles in the venation of PERLARIA. Long ago Comstock (1918, p. 249) wrote as follows:—

“I am convinced . . . that only the first forking of the radial sector, the division of this vein into veins $R_2 +_3$ and $R_4 +_5$, is primitive (*i.e.* for the PERLARIA); and that in those cases where the radial sector is more than two-branched, the additional branches have been developed secondarily.

“It is also evident that only the first forking of media, the division of this vein into veins $M_1 +_2$ and $M_3 +_4$, is primitive, for the farther branching of these veins is too inconstant and erratic to be considered primitive.”

As Comstock had postulated, for his hypothetical ancestral type of wing-venation, a four-branched Rs and also a four-branched M, the above facts remained for him an unsolved puzzle.

Now in all the PROTOPERLARIA the vein called M by Comstock

proves to be compounded of Lameere's two elements, viz. the anterior convex vein MA and the posterior concave vein MP. Further, it is universally true in this fossil Order that MA in the hind-wing is fused basally for a stretch with Rs. In modern PERLARIA (see figs. 1, 3, 13) such a fusion is universally present in the hind-wing between Rs and the assumed vein M of Comstock. Moreover, in all PROTOPERLARIA, both in the fore- and hind-wings, MP is seen to be *in process of degradation*, its basal portion having lost its chitinization and having become a mere concave groove in the wing membrane. The logical outcome of this process, if continued further, would be to eliminate this vein altogether, and to leave, in consequence, a rather wide field between veins MA and Cu₁. *The more archaic types of existing PERLARIA have such a broad field.* In *Artinska* we can see that already the cross-vein formation is leading up to the alignment of a series of medio-cubitals and inter-cubitals, as in recent PERLARIA. Also, in *Artinska*, there remain many types with MA in the fore-wing still quite separate from Rs, though the tendency to fuse basally with that vein, already achieved in the hind-wing, is seen to be actually consummated in many types of PROTOPERLARIA. Further, *Artinska* has both MA and Rs basically two-branched, which is the condition postulated by Comstock as ancestral for the Order PERLARIA.

An examination of any archaic type of PERLARIA, *e.g.* one of the AUSTROPERLIDAE or EUSTHENIIDAE, indicates the strong convex nature of the vein called M by Comstock. This vein, however, is always a concave vein in other Orders. Thus we arrive at a complete proof that the media of the PERLARIA is the convex vein MA of Lameere, and that the concave vein MP (Comstock's M) has been suppressed long ago.

A further point of interest is that all PROTOPERLARIA possess only *two* anal veins in the fore-wing, 1A and 2A, both convex. In the hind-wing, 1A is simple; 2A forms a four-branched *anal fan*, of which the first branch is forked. This agrees with the tracheation of nymphal wings of PERLARIA. The vein called 3A by Comstock is merely a branch of 2A, secondarily developed.

In view of the above evidence I have labelled the media in this paper MA, using the notation MA₁ and MA₂ for its two primary branches; and I have also discontinued the notation 3A in the system of anal veins.

FAMILY PERLIDAE.

Subfamily NEOPERLINAE.

Enderlein (1909) defines the subfamily NEOPERLINAE by the following characters :—Only two ocelli present. Two axillary veins (*i.e.* a forked 2A) run out from the basal anal cell in fore-wing. Beyond the anastomosis (*i.e.* transverse cord) in fore-wing, Rs is usually three-branched, seldom two- or four-branched.

The absence of the median ocellus and the forked nature of the vein 2A in fore-wing appear to be sound characters on which to base this subfamily. There is, however, so much variation in the venation of that part of the wing distad from the transverse cord that I think the condition of Rs should be omitted from the definition.

Genus OCHTHOPETINA End.

1909. Stettin, Entomol. Zeit., 70 Jahrg., p. 324.

This genus was separated off from *Neoperla* Needham by Enderlein to contain the Ethiopian and Oriental species originally included within *Neoperla*. The type of the latter genus is *N. clymene* (Newm.) from North America, and it originally included species also from South America as well as Africa and Malaya. The North American forms are easily distinguished from all the rest by the fact that, in the hind-wing, the fused basal portions of veins Rs and M (fig. 1, Rs+M) is very short, whereas in the other forms it is much longer, either about equal to, or longer than, the forked parts of these veins proceeding from it to the transverse cord. The genus *Ochthopetina* End., type *O. aëripennis* End. from Java, is distinguished from the genus *Macrogynoplax* End., which includes the South American species, by the short subgenital plate of the female; in *Macrogynoplax* this plate is double as long as the rest of the sternite, and nearly reaches the posterior border of the tenth sternite.

As I have not seen any of the Oriental species of *Ochthopetina*, I am not able to criticise Enderlein's placing of the Ethiopian and Oriental forms together in one genus. If they are really as closely related as Enderlein's grouping would lead us to suppose, the fact is of considerable interest, as it reinforces a large number of similar cases in other groups of insects.

Ochthopetina transvaalensis (End.).

(Fig. 1.)

1909. Zool. Anz., xxxiv, p. 402 (Zoutpansberg).

Of this apparently widespread species the collection contains five specimens: two from M'fongosi, Zululand, collected by W. E. Jones, March 1911, and three from Otjimbumbe, Kunene River, South West

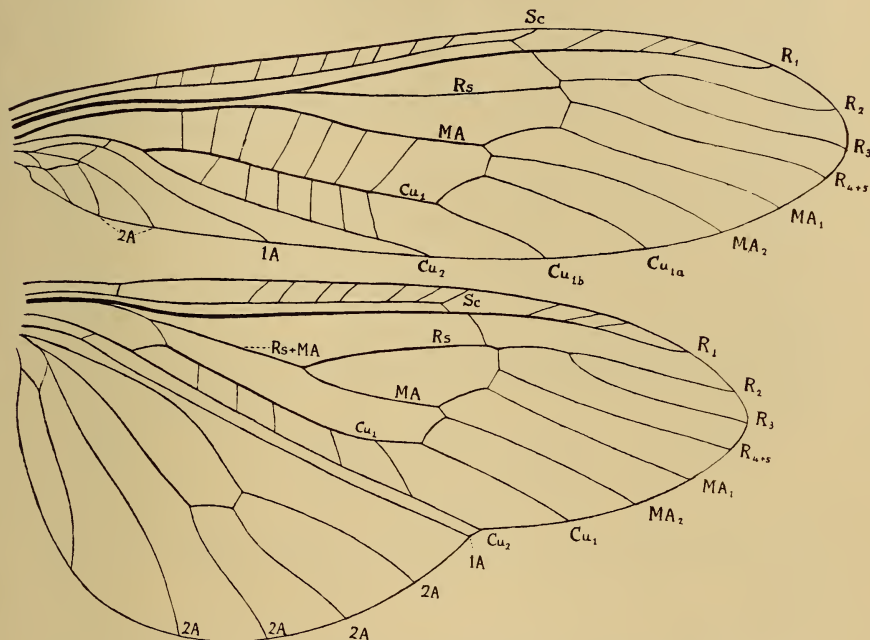


FIG. 1.—*Ochthopetina transvaalensis* (End.). Wings. Length of fore-wing 15 mm. Comstock-Needham System of notation, except MA, anterior or convex media.

Africa, collected by the Museum expedition to South West Africa, March 1923.*

The length of the fore-wing ranges from 13 to 16 mm.; its venation distally from the transverse cord is very variable, and in some specimens M appears to be three-branched, owing to the upper fork of

* There are other specimens in the South African Museum collection from the following localities:—Erikson's Drift, Kunene River (Museum Expedition, March 1923); Lydenburg, Transvaal (P. Kroeger); Howick, Natal (Symons, 1917); Krantz kop, Natal (K. H. Barnard, November, 1917); Upington, Cape (Sollier, 1919).—EDITOR.

Cu_1 becoming transferred to it and the lower fork of the same vein developing an additional small distal fork. Also the most posterior branch of Rs, *i.e.* R_4+5 , may arise from the transverse cord or it may arise markedly distad from it. Other variable characters are :—the number and position of the cross-veins between M and Cu_1 in fore-wings, and of the intercubitals in both wings ; the length of Sc in hind-wing (sometimes ending close up to the transverse cord, sometimes well short of it) ; the number and position of the pterostigmatic veinlets ; the closeness of the ocelli (sometimes practically touching, sometimes nearly one diameter apart) ; the distinctness of the typical sculpturing of the head and pronotum ; and the size and colouration of the specimen (one specimen from Zululand is markedly darker than the rest).

Attention should be drawn to the peculiar character of vein 2A in the hind-wing (fig. 1). This vein, after approaching very close to 1A at about one-third of its length, bends strongly away from it before it forks at about two-thirds of its length. This character appears to me so peculiar that I think it should be included in the generic definition, if, as I surmise, it occurs in other species of *Ochthopetina*. The Oriental species should be studied also for the condition of this vein.

FAMILY NEMOURIDAE.

Subfamily NEMOURINAE.

The subfamily is easily recognised by the form of the tarsi, in which the second segment is much shorter than either of the other two (fig. 2).

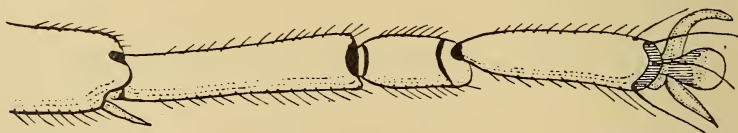


FIG. 2.—*Aphanicerca capensis* n. g. et sp. Middle tarsus with apex of tibia and tibial spur. $\times 100$.

The two new genera represented in the collection may be distinguished as follows :—

Fore-wing with Rs and M arising separately from R ; no striking colour-pattern	<i>Aphanicerca</i> n. g.
	(Genotype <i>A. capensis</i> n. sp.)
Fore-wing with Rs and M arising together from R ; a striking colour-pattern of broad dark transverse fasciae present	<i>Desmonemoura</i> n. g.
	(Genotype <i>D. pulchella</i> n. sp.).

APHANICERCA n. g.

(Figs. 2-9.)

♂ *Fore-wing* (fig. 3).—Sc ending on costa at or near its middle, and supported either at or just before its end by a cross-vein descending to R_1 and continuous with the transverse cord. Pterostigma very long, without veinlets (rarely an adventitious one, or part of one).

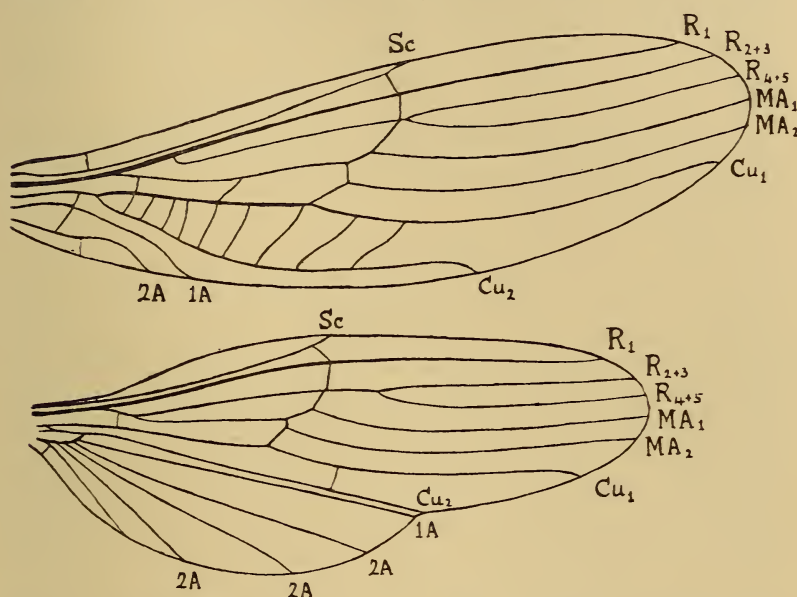


FIG. 3.—*Aphanicerca capensis* n. g. et sp. Wings. Length of fore-wing 7 mm. Venational notation as in fig. 1.

R_s arising from R at a very marked angle (sometimes almost a right angle) at about one-fifth to one-fourth of wing-length, and dividing into two branches, R_2+3 and R_4+5 , either at, or very slightly distad from, the transverse cord. M arising by a much more acute angle separately from R at one-sixth of the wing-length or less from base. Cu_1 simple, extending far beyond end of Cu_2 to a point not far short of apex of wing. All the veins distad from transverse cord very evenly spaced, subparallel; no cross-veins in this part of wing, except an occasional adventitious one just distad of transverse cord between lower branch of M and Cu_1 . Between base and transverse cord, normally only two cross-veins between M and Cu_1 , rarely three.

Eight to eleven intercubital cross-veins, of which two or three lie distad from the lower end of the transverse cord. Only two anal veins, connected not far from base by a strong cross-vein. 1A simple, wavy. 2A with a descending spur about half-way, thence more or less arched.

Hind-wing (fig. 3) with strongly arched costa to end of Sc (at about half-way or slightly less). Rs forking markedly distad from transverse cord. Rs and M arising together from R by a very short common stalk, with descending cross-vein to Cu_1 . A single intercubital cross-vein placed well distad from level of transverse cord. Anal fan narrow, with five simple veins, including 1A; the fifth rather short, and with a very short spur-vein at its base.

Legs with tibia longer than femur; tarsi short, their second segment much shorter than either of the other two.

Cerci vestigial or absent.

Genotype.—*Aphanicerca capensis* n. sp.

This genus shows marked affinity with *Spaniocerca* Till. from Australia and New Zealand, particularly in the mode of origin of Rs and M in fore-wing, in the general structure of the hind-wing, in the form and details of the anal areas of both wings, in the arrangement of the cross-veins between M and Cu_1 in fore-wing, the intercubitals in fore-wing, and the single distally placed intercubital cross-vein in hind-wing. It is easily distinguished by the form of Sc, which, in *Spaniocerca*, arches up to touch the costa and then curves gently down on to R_1 , with an extension in the form of a pterostigmatic veinlet further distad, and also by the absence of the sharp downward curve of Cu_1 on leaving the transverse cord, which is a marked feature of *Spaniocerca*. In these characters one must regard the new genus as being more archaic than *Spaniocerca* itself, though in other respects, notably in the structure of the male genitalia, it appears to be more specialised.

The new genus is also allied to *Notonemoura* Till. from New Zealand, from which it can be distinguished by its narrower and longer wings, narrower anal fan of hind-wing, absence of pterostigmatic veinlets, and form of Sc; this latter vein, in *Notonemoura*, forks evenly at its distal end. *Notonemoura* agrees with *Aphanicerca* in the even arrangement of the veins of the distal part of the fore-wing, but the fork of Rs takes place in such a way that a short portion of R_2+3 is included in the transverse cord, while Rs itself continues through the cord directly along R_4+5 ; in like manner, in *Notonemoura*, a short portion of the upper branch of M forms part of the cord, but M itself

runs through the cord directly into its lower branch. Thus the composition and form of the cord in these two genera is markedly different. This is also true for the hind-wing, where, in *Notonemoura*, the intercubital cross-vein is very small and closer to the base of the cord, the three veins M_3+4 , Cu_1 , and Cu_2 running very close together.

There appear to be three closely allied species of this genus in the collection, which may be distinguished as follows:—

1. Comparatively large species, fore-wing about 8 mm. long, with more or less clearly marked pale irregular band crossing the darker wing about its middle :
male with large dorsal processes on abdominal segment 7 . *A. capensis* n. sp.
Comparatively small species, fore-wing 5–6 mm. long, of uniform colouration ;
male without dorsal processes 2.
2. Paraprocts of male with paired flagella ; edges of copulatory groove strongly denticulate *A. denticulata* n. sp.
3. Paraprocts without flagella ; edges of copulatory groove only extremely minutely serrate *A. barnardi* n. sp.

Aphanicerca capensis n. sp.

(Figs. 2–4.)

♂. *Total length*, 6·4 mm. ; *hind-leg*, 7 mm. ; *fore-wing*, 7 mm. long by 2 mm. wide. *General colour*, medium brownish fuscous, the head and antennae darker, with a slight russet tinge, the pronotum dark fuscous, the legs brownish tinged with russet, and much darkened towards distal ends of femora ; fore-wings subhyaline tinged with light brownish fuscous, with a markedly more hyaline area, of irregular shape, crossing the middle, just distad from the transverse cord, and much broader posteriorly than anteriorly ; this pattern gives the wings, when folded, a marked appearance of alternate light and dark transverse areas, but too diffuse and irregular to be termed fasciation (contrast the colour-pattern of the wings in *Desmonemoura* n. g. below) ; hind-wings subhyaline.

Head about as wide as pronotum ; *ocelli* very small ; *antennae* (broken) evidently as long as, or longer than, fore-wing, scape large, longer than wide, pedicel about as wide as long but much smaller than scape, third segment subcylindrical, much narrower than pedicel, nearly thrice as long as wide, fourth and following segments much shorter than third, cylindrical, becoming gradually longer towards the distal end of the organ ; thirty-one segments are present in left antenna of holotype male (broken) ; *maxillary palpi* with small first and second segments, third and fourth equal, longer, fifth longer than fourth, oval. *Eyes* black, *occiput* dark russet.

Thorax.—*Pronotum* squarish, slightly broader posteriorly, lateral margins slightly convex, dark fuscous tinged with russet in middle; *pterothorax* considerably wider than prothorax.

Abdomen about 3 mm. long; dorsally from the posterior margin of seg. 7 there is developed a pair of very strong, diverging processes shaped as in fig. 4a, dark brown with black ridges. *Cerci*, 0.3 mm. long, rather slender, hairy, with rounded apices (fig. 4c). *Paraprocts*

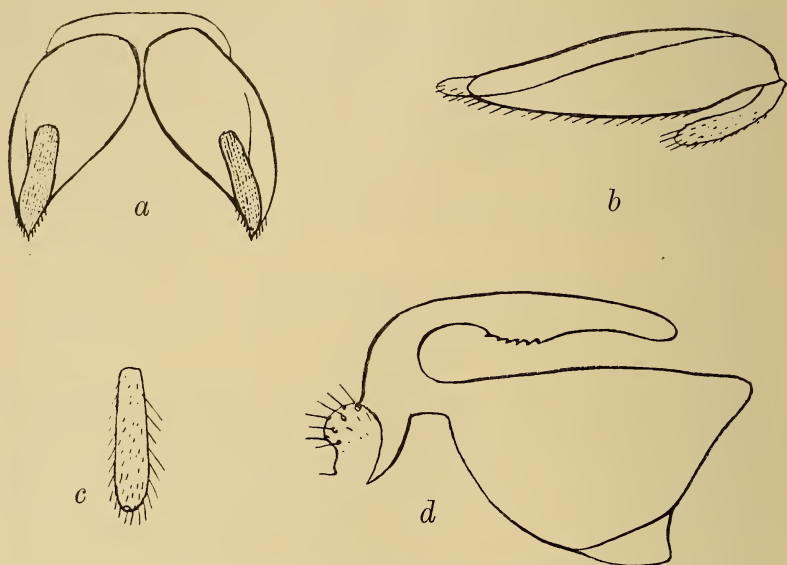


FIG. 4.—*Aphanicerca capensis* n. g. et sp. a, Dorsal processes of segment 7, male. $\times 120$. b, Subgenital plate, male. $\times 60$. c, Cercus, male. $\times 60$. d, Paraproct, male. $\times 60$.

(fig. 4d) 0.4 mm., subtriangular, with a dorsal extension forward from hinder angle in the form of a hard, rather slender process with a slightly enlarged denticulate area on its lower margin; these two processes, in the position of rest, lie close to one another and to the middle line. *Subgenital plate* (fig. 4b) large, sheath-like, its apex somewhat pointed and ending in a softly chitinous flap; a small, softly chitinated process projects below its base.

Wings.—General scheme of venation as given in the generic definition (fig. 3). Of specific value may be noted the very characteristic ending of Sc and also the ending of Cu₂ well beyond half-way along the posterior margin.

♀. Somewhat more robust and darker coloured than male; forewing 7–8 mm. long. Abdomen ending in a pair of broadly triangular

subanal plates, hairy, with moderately pointed and slightly nodding apices; *cerci* very short, broadly rounded at apex, hairy.

Occasional additions to the normal venation are to be seen in both sexes, notably an additional cross-vein above Cu_1 in fore-wing, just distad from transverse cord; an additional (third) medio-cubital cross-vein in fore-wing; a pterostigmatic veinlet, either wholly or only partially formed, just distad from end of Sc in both wings; doubling of the subanal veinlet or strut from 2A to posterior margin in fore-wing.

Types.—Holotype male and allotype female, mounted on slides, the bodies treated with KOH, the wings cleared and mounted separately; both from tube of specimens preserved in alcohol, taken on Table Mountain, by K. H. Barnard, 25th January 1929.

Localities.—Table Mountain, Cape Town (October 1917 and January 1929); Winterhoek Mountains, Tulbagh (August 1929); Wellington Mountains, 4000 feet (December 1924); Jonker's Hoek, Stellenbosch (May 1924). A dark female form, with the pale area of the fore-wings much restricted, was taken at Lemoens Hoek, Heidelberg, Cape Province, in November 1927. A small male, fore-wing only 5.8 mm. long, and a small female were taken at Klein Drakenstein, October 1925. The species is evidently widespread and not uncommon at high altitudes. All specimens collected by K. H. Barnard.

Aphanicerca denticulata n. sp.

(Figs. 5, 6a.)

♂. *Total length*, 6 mm.; *fore-wing*, 5.7 mm. long by 1.8 mm. wide. *General colouration* dull brownish fuscous, head and antennae somewhat darker; legs medium brownish fuscous, femora not markedly darkened apically.

Head.—The *antennae* differ from those of *A. capensis* n. sp. in having the scape almost bulbous, very wide, and not longer than wide, the pedicel only half as wide as the scape, and not longer than wide, the third and following segments not cylindrical, but all somewhat wider distally than basally, the third barely twice as long as wide, the fourth and following segments shorter than the third, but becoming gradually longer distally. Forty-seven segments can be counted on one antenna and forty-five on the other, neither being complete. The *maxillary palpi* have the third segment longest, and both third and fourth are widest distally; the fifth segment is markedly more

pointed apically than in *A. capensis*, and is also the longest segment of the five.

Thorax.—The *pronotum* is markedly wider than long, sub-rectangular, with a fine median longitudinal line.

Abdomen.—There are no dorsal processes as in *A. capensis* n. sp., but there is a median grooved appendage developed below and between the cerci which is not present in *A. capensis*. Viewed ventrally, this

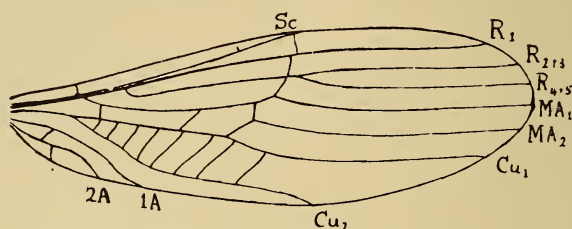


FIG. 5.—*Aphanicerca denticulata* n. g. et sp. Fore-wing. Length 5·7 mm. Venational notation as in fig. 1.

appendage is scissors-shaped (fig. 6a), with the two loops placed posteriorly and the narrow process projecting anteriorly; the sides of this latter are markedly denticulate. The *paraprocts* are much larger, their forward processes weakly chitinized, double. *Cerci* shorter and stouter than in *A. capensis*, hairy. *Subgenital plate* very short, basal appendage minute.

Wings (fig. 5) almost unicolorously tinged with brownish fuscous, slightly darker at base and along costa of fore-wing. Venation closely similar to that of *A. capensis*, but with Sc arching up distally to end in costa exactly at the point where the transverse cross-vein descends to the transverse cord. Cu_2 not quite as long as in *A. capensis*, in fore-wing; in hind-wing the distal intercubital cross-vein is placed nearer margin of wing than base of transverse cord.

♀ unknown.

Type.—Holotype male, mounted on slide, body treated with KOH, wings cleared and mounted separately, from specimen preserved in alcohol, taken on Winterhoek Mountains, Tulbagh, by K. H. Barnard, August 1929.

Aphanicerca barnardi n. sp.

(Figs. 6b, 7–9.)

♂. Total length, 5 mm.; fore-wing, 5·4 mm. General colour brownish. This species is evidently closely allied to *A. denticulata*

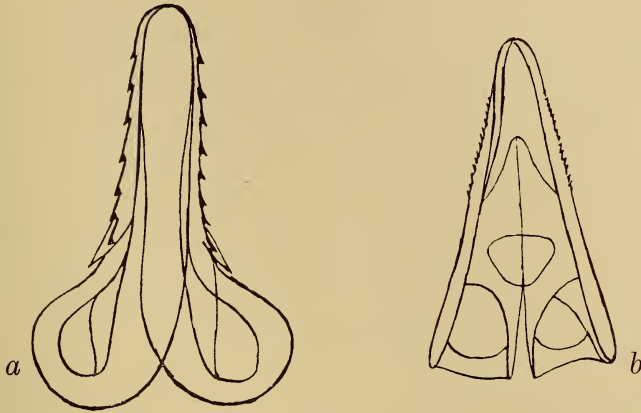


FIG. 6.—*Aphanicerella* n. subg. Dorsal grooved appendage of male, flattened by mounting. $\times 120$. *a*, *A. denticulata* n. sp. *b*, *A. barnardi* n. sp.

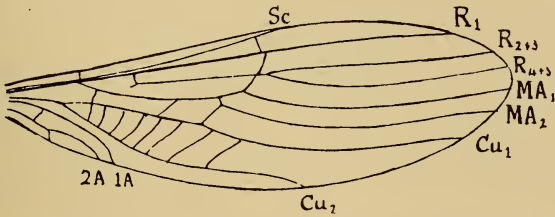


FIG. 7.—*Aphanicerca barnardi* n. g. et sp. Fore-wing. Length 5.4 mm. Venational notation as in fig. 1.

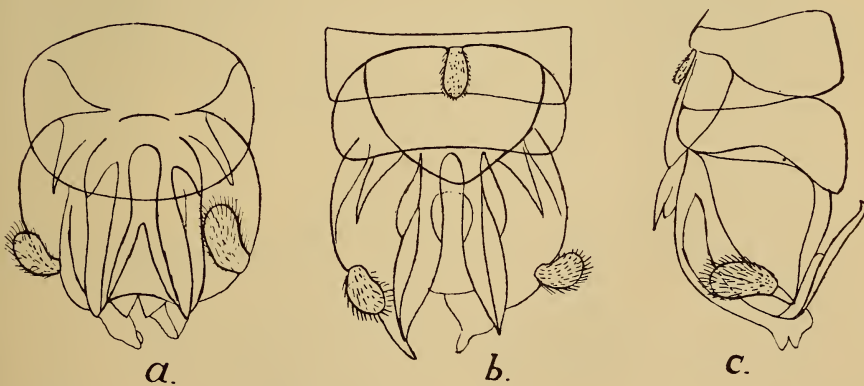


FIG. 8.—*Aphanicerca barnardi* n. g. et sp. Male appendages cleared in KOH 10 per cent. solution, and drawn before mounting. *a* dorsal, *b* ventral, and *c* lateral views.

n. sp., and like the latter differs from *A. capensis* in having no dorsal processes on the abdomen of the male and in possessing a median grooved appendage below and between the cerci. This appendage (fig. 6b) differs in shape from that of *A. denticulata*, and the margins of its anterior process are not denticulate but only very minutely crenulate. The paraprocts also differ in form, their forward processes begin single, strongly chitinized, but ending in rather soft, fleshy projections. Cerci short and stout, larger than in *A. denticulata* and with longer hairs. Subgenital plate broad and well developed, shaped as in fig. 8b, with a short but quite distinct basal appendage. Fig. 8a, b, c shows the very complex male genital region in dorsal, ventral, and lateral view respectively.

Wings (fig. 7) subhyaline, with brownish fuscous veins. The descending cross-vein of the subcosta is placed definitely before the end of that vein. At the curve of Rs in fore-wing, close to its origin, there is a short spur-vein directed basad, suggesting the course of evolution by which, very probably, the fused condition of Rs and M in the fore-wing of the next genus (*Desmonemoura* n. g.) has been attained. Anal area of fore-wing markedly narrower than in *A. denticulata*, the course of IA being different and closer to Cu₂.

♀ closely similar to male in general appearance. Ventrally the abdomen has a transverse hard chitinous area on seg. 7, a divided subgenital plate on seg. 8, a large, partially divided subanal plate on seg. 10, and small, fairly slender, slightly curved cerci, as shown in fig. 9.

Types.—Holotype male, mounted on slide, body treated with KOH, wings cleared and mounted separately, from specimen preserved in alcohol; taken at Fairy Glen, Worcester, Cape Province, by K. H. Barnard, June 4, 1929. Allotype female (abdomen only) similarly treated, from damaged example, same series of specimens. Paratype male, from same locality, mounted entire on slide. Abdominal appendages of ♂, mounted on slide, from damaged specimen in alcohol; also wings and legs on separate slides.

Following the practice of some European authors, the above three species may be divided into two groups having subgeneric rank, as follows :—

- | | |
|---|--|
| Male with dorsal processes from seventh abdominal segment, but without a dorsal grooved appendage below and between cerci | Subgenus <i>Aphanicerca</i> n. g.
(Type <i>Aphanicerca capensis</i> n. sp.) |
| Male without any dorsal processes, but with a dorsal grooved appendage below and between cerci | Subgenus <i>Aphanicercella</i> n. subg.
(Type <i>Aphanicerca barnardi</i> n. sp.) |

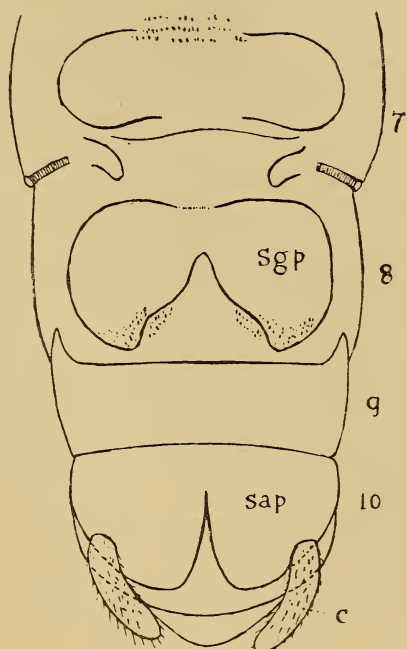


FIG. 9.—*Aphanicerca barnardi* n. g. et sp. Last four segments of abdomen of female, ventral view. $\times 56$.

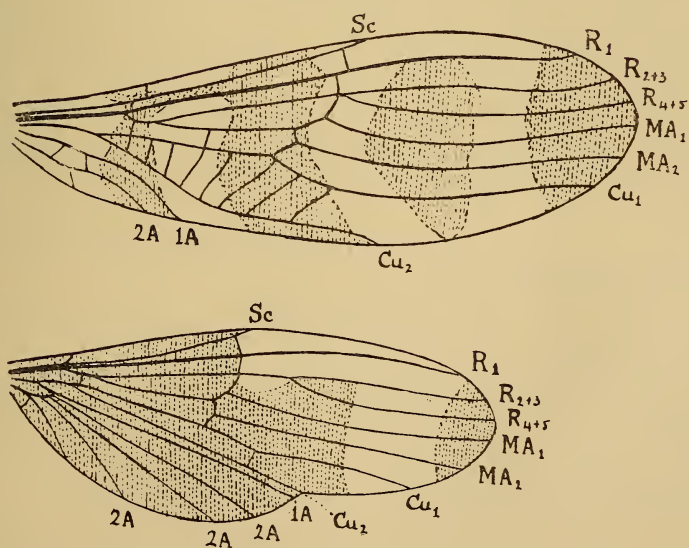


FIG. 10.—*Desmonemoura pulchellum* n. g. et sp. Wings. Length of fore-wing 5.8 mm. Venational notation as in fig. 1.

A. barnardi n. sp. is designated as the type of the new subgenus *Aphanicerella* because both sexes are known and it appears to be a commoner species than *A. denticulata* n. sp.

DESMONEMOURA n. g.

(Fig. 10.)

This genus is to be regarded as a specialised offshoot from the older genus *Aphanicerca* n. g. It differs from it in the following characters:—

Fore-wing with Rs and M arising by a common stalk from R, and with a strongly marked pattern of dark transverse fasciae. Male with very complex terminal appendages, possessing two pairs of forcipate appendages, one pair formed from the cerci and another from the paraprocts.

Genotype.—*Desmonemoura pulchellum* n. sp.

Desmonemoura pulchellum n. sp.

(Figs. 10, 11.)

♂. Total length, 7 mm.; fore-wing, 5.8 mm. long. *General colouration* strongly banded in very pale and very dark brown. Head, pterothorax, and end of abdomen dark brown, prothorax and most of abdomen very pale; legs pale, except last segment of tarsus, which is dark.

Head.—*Antennae* with basal segments somewhat similar to those of *A. capensis* (broken); *maxillary palpi* also similar to those of *A. capensis* in form, but longer, being about as long as the width of the head.

Thorax.—Pronotum rectangular, somewhat wider than long, without a mid-longitudinal line.

Abdomen.—No dorsal processes present. The very complex terminal appendages are shown in ventral view in fig. 11; note the cerci (*c*) forming one pair of forcipate appendages, distinguished by the hairs on their distal portions, and a second pair of forcipate appendages formed from the paraprocts (*pp*), and not hairy; there is also a complex median appendage, a pair of shorter processes, and a triangular subanal plate with small basal hairy process (*bp*).

Wings.—Fore-wing (fig. 10) beautifully banded with irregular transverse fasciae of dark brown on a pale, subhyaline ground. Four

of these bands may be distinguished, the first and third not reaching the costa, and the fourth occupying the apical area of the wing. The second fascia reaches posteriorly to the end of Cu_2 , which is barely beyond the level of the end of Sc. Hind-wing (fig. 10) mostly darkly

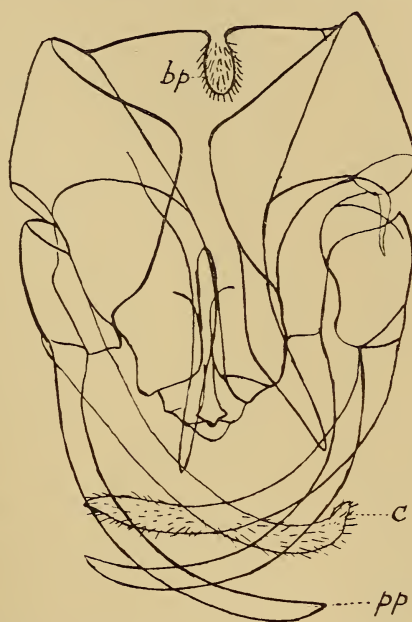


FIG. 11.—*Desmonemoura pulchellum* n. g. et sp. Appendage of male, flattened by mounting. Ventral view. $\times 56$. *bp*, Basal process of subgenital plate; *c*, cercus; *pp*, process of paraproct.

shaded, but with pale, subhyaline area extending along costa from transverse cord to near apex and extending right across to posterior margin covering the apical part of Cu_1 .

♀ similar to male, but without the forcipate appendages; subanal plate divided into two broadly triangular lobes, pale in colour; subgenital plate also pale, shorter.

Types.—Holotype male, mounted on slide, body treated with KOH, wings cleared and mounted separately, from specimen preserved in alcohol, taken at Banhoek, near Stellenbosch, by K. H. Barnard, October 7, 1929. Allotype female, pinned specimen, taken by K. H. Barnard on Winterhoek Mountains, Tulbagh, 4000 feet, November 1917. One paratype from same locality, two from Tradouw Pass, Swellendam, November 1925 (K. H. Barnard).

LARVAE.

(Figs. 12, 13.)

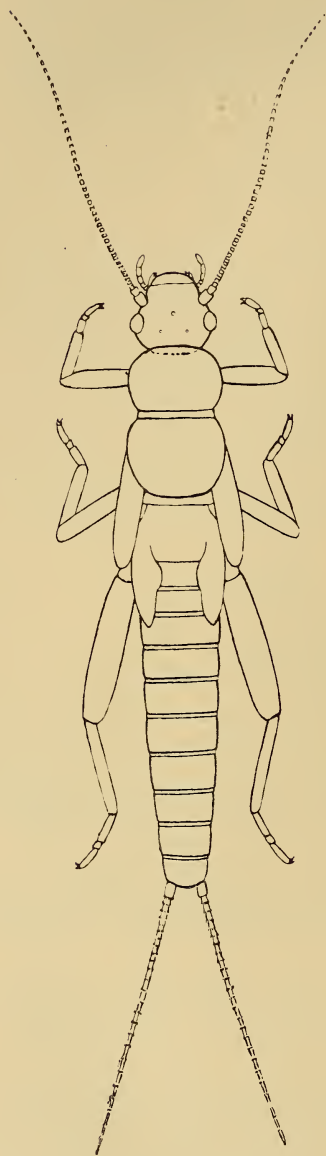


FIG. 12.—Full-grown larva of an undetermined species of *Aphanicercus* from Banhoek near Stellenbosch. $\times 16$. Missing portions of antennae and cerci restored.

In the collection are two specimens of larvae of *Perlaria* preserved in alcohol, both from Banhoek, near Stellenbosch (taken by K. H. Barnard, October 7, 1929). Neither of these larvae possess any external gills. The smaller of them is in the last instar, and has the venational scheme clearly marked on the wings as pale veins on a fuscous background. It is therefore possible to determine the genus without any doubt, and the venation proves that this larva belongs to the genus *Aphanicercus*. It is in rather poor condition, with the antennae and cerci badly broken off. After treatment with KOH, the larva was cleared and mounted on a slide, and one of the maxillary palpi was dissected out. Fig. 12 shows the reconstructed larva (length of body 6 mm.), with probable form of antennae and cerci; fig. 13 shows the structure of the maxillary palp. The general colour of this larva is pale brownish, without any pattern.

A comparison with known larvae of *Nemoura* and *Leuctra* shows that this larva is, as might be expected, somewhat intermediate between the two. In its general form it comes closest to *Nemoura*, particularly in the large and robust legs and robust build of thorax. The mandibles have both incisor and molar series of teeth strongly developed, but the ciliation of the inner margin is only poorly developed. The maxilla differs from that of both *Nemoura* and *Leuctra* in that the galea

and lacinia are just about of equal length; in these other genera the galea is the longer, especially in *Nemoura*. The maxillary palp has the distal segment longest, rather narrow oval in shape, somewhat pointed (fig. 13).

The larger larva, which is in better condition, was cleared and mounted without treatment by KOH. It is in the penultimate instar and therefore its generic position cannot be determined from the wing-venation. As, however, the colouring is medium brown on the thorax and legs, with the head and most of the abdomen markedly darker, it is reasonable to suppose that it belongs to the strongly banded species *Desmonemoura pulchellum* n. g. et sp., adults of which were taken by Dr. Barnard along with it. Length of body, 7.2 mm.; antenna, 4.8 mm.; cerci, 3.8 mm. The general form is very similar to the smaller larva, but there are some important differences, as follows: The maxillary palpus has the last segment narrow, cylindrical, with apex bluntly rounded; the pronotum is more rectangular, markedly wider than long; the legs are even more robust than in the smaller species, and in particular the femora are much broader, with a flattened fusiform outline; the tenth segment of the abdomen is divided or notched medially, and the paraprocts are very hairy; the antennae and cerci are much as in the restoration of the smaller larva in fig. 12, the segments of the cerci having whorls of a few short hairs at the apex (omitted in the figure).

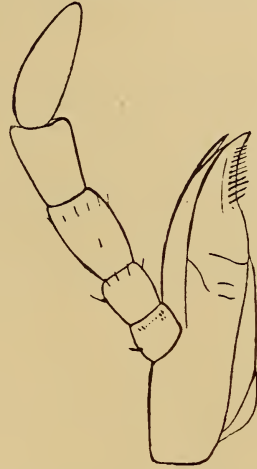


FIG. 13.—First maxilla of the larva, shown in fig. 12, of an undetermined species of *Aphanicerca* n. g. $\times 90$.

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